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(71) Applicant: TIVO, INC. [US/US]; 2160 Gold Street, San Jose, CA 95164 (US).

(72) Inventors: HEATON, Kurt; 1730 Beachwood Way, Pleasanton, CA 94566 (US). WATERMAN, Alan; 112 Cherry Wood Court, Los Gatos, CA 95030 (US). KAO, Jean; 21876 Meadow View Lane, Cupertino, CA 95014 (US).

(74) Agents: GLENN, Michael, A. et al.; Law Offices of Michael A. Glenn, 3475 Edison Way, Ste. L., Menlo Park, CA 94025 (US).

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(54) Title: METHOD AND APPARATUS FOR CONTROLLING AT LEAST ONE SET–TOP BOX

(57) Abstract

A method and apparatus for providing control of a set–top box through IR blasting control by a system containing at least one computer is discussed. The system is coupled to a mass storage system. The system includes an IR control database that resides on the mass storage system. The IR control database contains at least one IR control entry and an IR control packet. The IR control packet is generated from a first IR control entry of the IR control database. The system controls a set–top box by serial transmission of the IR control packet.

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# METHOD AND APPARATUS FOR CONTROLLING AT LEAST ONE SET-TOP BOX

## Technical field

This invention relates to controlling set-top boxes in a television-related environment.

## Background Art

Originally, televisions possessed a simple user interface containing a channel selector, volume control and little else. Since the advent of video tape technology, these controls have been extended far beyond this.

A standard approach to controlling what are now known as set-top boxes is the use of hand held remote control devices using Infra-Red (IR) signals to communicate with set-top boxes and recently with additional devices, often found in home entertainment centers. There have been set-top control units also controlling other devices with this IR blasting technology which are not hand held. To date, these IR blasters have been driven by an embedded microprocessor using an embedded non-volatile memory chip to store the control tables specifying the IR signaling required for communication with various devices. Such devices are now pervasive throughout the consumer electronics of many continents.

However, such devices have some limitations that often cause significant frustration. Non-volatile memory chips used in such IR controllers offer limited amounts of memory, usually no more than one megabit. Such small memories are limited in terms of holding the rapidly growing database of distinctive device protocols in use by the various consumer devices. It is a common problem that a device operating in the correct frequency range cannot generate the necessary signaling to adequately communicate with a newly purchased device such as a set-top box component in a home entertainment center.

Another problem often encountered, even when a device may be able to add the control information to communicate with a new device, is that there is no readily supported

mechanism by which that information can be programmed into the non-volatile memory chip.

Another problem encountered is the inability of contemporary IR controllers to select channels located on both A and B switch settings of a set-top box. Worse yet, existing IR controllers are further unable to select channels on these two setting as well as support the C band setting used in some satellite television services.

Another problem encountered in contemporary IR controllers is that different set-top boxes require essentially syntactic presentation controls. These set-top boxes have different responses to signals. often requiring specific minimum delays between digits or symbols being IR blasted to them. Another similar problem comes in the use of enter or cancel keys to delimit ending an IR blasting sequence. Another similar problem is establishing how many digits are expected to define a channel. In each of these problems, variations among different set-top boxes lead to a lack of uniformity challenging the patience of consumers, because today, there is no solution to any of these problems.

To summarize, what is needed includes IR blasting controls not limited to a small non-volatile memory capacity for holding signaling details for various units controlled by IR blasting. What is further needed includes a mechanism or method for rapidly updating an existing IR blaster control unit to incorporate signaling details for new devices. What is also further needed is a flexible ability to support channel selection on A/B switch and A/B/C switch controlled set-top box systems. What is further needed is a method of solving essentially syntactic presentation control problems.

## Disclosure of the invention

Various embodiments solve all of these problems.

Certain embodiments include a method and apparatus for providing control of a set-top box through IR blasting control by a system containing at least one computer: the system is coupled to a mass storage system. These embodiments include providing an IR control database residing on the mass storage system where the IR control database contains at least one IR control entry, providing an IR control packet where the IR control packet is

generated from a first IR control entry of the IR control database, and providing control to the set-top box by serial transmission of the IR control packet.

These embodiments are advantageous in providing an IR control database residing on the mass storage system. Such solutions remove any memory constraints on the size of the IR control database, thus solving the memory constraint problem of the prior art.

Certain further embodiments additionally include the following: Providing an IR control database residing on the mass storage system, where the IR control database contains at least one IR control entry; providing reception of an IR control entry to create a received IR control entry; and providing insertion of the received IR control entry to create the first IR control entry of the IR control database.

Such embodiments are advantageous in supporting the reception of updates and additions to the IR control database remotely. By way of example, such embodiments facilitate IR blasting control code signaling protocol upgrades as new equipment is integrated into a home entertainment system

Certain further embodiments additionally include the following: Providing a raw IR control library residing on the mass storage system, where the raw IR control library contains a first raw IR control entry; providing library parsing of the first raw IR control entry of the raw IR control library to create a processed first IR control entry; and providing communication of the processed first IR control entry to create the first IR control entry of the IR control database.

Such embodiments advantageously support a raw IR control library to be acquired, shared and updated with other manufacturers.

Certain other further embodiments additionally include the following: Providing a prototype IR control database residing on the mass storage system, where the prototype IR control database contains a first prototype IR control entry; providing a control code search accessing the prototype IR control database to select a first prototype IR control entry; and generating from the first IR control entry the first raw IR control entry of the raw IR control library.

Such embodiments are advantageous in providing a systematic interface between a prototype laboratory and the raw IR data library. Such an interface permits automated updating of the raw IR data library, which in turn supports automated updating of the IR control database through the library parsing mechanism.

Certain other further embodiments additionally include the following: Providing a corrections-additions database residing on the mass storage system, where the corrections-additions database contains a first correction data entry; and providing the library parsing of the first correction data entry and of the first raw IR control entry to create the processed first IR control entry.

Such embodiments advantageously support corrections and additions to the control code tables which may be the result of continued testing beyond a prototype initial coding situation.

Certain other further embodiments additionally include the following: The processed first IR control entry includes a first processed IR control entry syntax specification; and the first IR control entry of the IR control database includes a first IR control syntax specification. Such embodiments advantageously support including essentially syntactic presentation controls into an IR control entry.

Certain further embodiments comprise a first IR control syntax specification which is included in the first IR control entry of the IR control database, including a number of digits in a channel specification. Such embodiments advantageously support specification of the number of digits in a channel specification.

Certain other further embodiments comprise a first IR control syntax specification entry which is included in the first IR control entry of the IR control database, including a delimiter specification ending an IR blast. Such embodiments advantageously support delimiter specifications ending an IR blast.

Certain other further embodiments include the first IR control syntax specification entry which is included in the first IR control entry of the IR control databas, including a delay specification between digits of an IR blast. Such embodiments advantageously support specifying delays between digits of an IR blast.

Certain other further embodiments include the first IR control syntax specification entry included in the first IR control entry of the IR control database including a prefix specification. Such embodiments advantageously support specifying prefix symbols in an IR blast.

Certain further embodiments comprise a prefix specification which is included in the first IR control syntax specification entry which is, in turn, included in the first IR control entry of the IR control database and which comprises an A/B switch prefix selection. Such embodiments advantageously support channel selection of both A channels and B channels.

Certain other further embodiments comprise a prefix specification which is included in the first IR control syntax specification entry which is, in turn, included in the first IR control entry of the IR control database and which comprises an A/B/C switch prefix selection. Such embodiments advantageously support additional channel selection of C channels.

Certain other further embodiments additionally comprise a system containing one computer. Such embodiments advantageously include the ability to develop prototyping IR blasting codes in an environment containing the standard (lower cost) consumer version to insure compatibility.

Certain other further embodiments additionally comprise a system containing a first computer and a second computer. The mass storage system comprises a first mass storage system coupled to the first computer and a second mass storage system coupled to the second computer. The IR control database comprises a first instance of the IR control database residing on the first mass storage system coupled to the first computer. The raw IR control library resides on the second mass storage system containing the first raw IR control entry. The system provides reception of the IR control entry to create a received first IR control entry using a method which includes providing reception of the IR control entry to create the received first IR control entry at the first computer.

Such embodiments advantageously support distribution of library parsed data entries from a raw IR control library which resides on the second mass storage system coupled to the second computer to IR control database instances which resides on the first mass

storage system coupled to the first computer. Note that in certain embodiments, the second computer is a server or distributor for IR control blasting code updates to numerous first computers in various consumers' set-top box control units.

Certain other further embodiments additionally include the system further containing a server computer system which provides reception of the IR control entry to create a received first IR control entry and that includes providing reception of the IR control entry to create a received first IR control entry by the server computer system.

Communication of the processed first IR control entry by the second computer to create the first IR control entry of the IR control database includes the following. Providing communication of the processed first IR control entry by the second computer to create the first IR control entry by the server computer system; and providing communication of the processed first IR control entry by the server computer system to create the first IR control entry of the first instance of the IR control database by the first computer.

Such embodiments advantageously provide a partitioning of the second computer and second mass storage system holding the raw IR control library from a server computer actually distributing IR control code updates to at least one first computer.

## Brief Description of the Drawings

Figure **1** depicts a system controlling a set-top box in accordance with certain embodiments;

Figure **2** depicts a system block diagram in accordance with certain embodiments;

Figure **3** depicts data flow regarding IR control of external set-top boxes in accordance with certain embodiments;

Figure **4** depicts a refinement of Figure 1 regarding IR control of external set-top boxes in accordance with certain embodiments;

Figure **5** depicts a system controlling a set-top box using a prototype test unit in accordance with certain embodiments;

Figure **6** depicts a network with server system **104**, a prototype set-top control system **102** and multiple set-top control systems **100-1** to **100-4**; and

Figure **7** depicts a hand held remote control unit **120** in accordance with certain embodiments.

## Detailed Description of the Invention

Figure **1** depicts a system **100** including set-top control unit **110** controlling an external set-top box **200** in accordance with certain embodiments.

Certain embodiments are implemented as an advanced set-top unit **110** packaged in a shipping container with cables, accessories, and a remote control **120**. Certain further embodiments provide control of cable and satellite set-top boxes **200** by IR control **114**. Certain embodiments support some satellite boxes **200** by serial control **114**. In certain embodiments, remote control unit **120** may be a TiVo Remote Control Unit, manufactured by or for TiVo, Inc. of San Jose, California.

The television source **202** can be from one of four sources: 1) a roof-top antenna or rabbit ears receiving terrestrial analog broadcast, 2) a buried coaxial cable delivering analog and digital cable signals, 3) a satellite antenna receiver digital satellite broadcast, and 4) a roof-top antenna receiving terrestrial digital broadcast.

If the signal source **202** is from a roof-top or rabbit ear antenna, the user connects the cable from the antenna directly to the RF input on the Set-top control unit. The internal tuner in the Set-top control unit set-top box is used to select which program to view or record. The viewer selects which channel to tune to by using the remote control unit **120**. After the selection is made, the Set-top control unit tunes its internal tuner to receive the channel selected.

If the signal source **202** is from a buried cable from a cable provider, the user can choose to 1) connect the cable to a analog set-top box, 2) connect the cable to a digital set-top box, or 3) connect the cable directly to the Set-top control unit. Note that in certain embodiments, the cable may be fiber optic. In certain other embodiments, the cable may be coaxial cable.

If the signal source **202** is from cable and the user has an analog cable set-top box, the cable is connected to the cable set-top box. Note that in certain embodiments, the cable may be fiber optic. In certain other embodiments, the cable may be coaxial cable. The cable set-top box contains an internal tuner that will be tuned to the channel the viewer wishes to view or record. The cable set-top box **200** is then connected **118** to the Set-top control unit **110** in one of two ways. 1) The channel selected is modulated onto either channel 3 or 4 and output on a RF connector. The RF connector is connected **118** to the RF input connector on the Set-top control unit **110** And the internal tuner **640** (see Figure **2**) in the Set-top control unit **110** is tuned to channel 3 or 4 to receive the channel. 2) The channel selected is output on either a composite or s-video connectors. These connectors are connected **118** to composite or s-video inputs on the Set-top control unit **110**. If available, the preferred connection **118** is using s-video; if s-video is not provided then the preferred connection **118** is composite in certain embodiments. Both s-video and composite provide higher quality connections **118** than RF in certain embodiments.

The viewer selects which channel to tune to by using the Remote Control Unit **120**. After the selection is made, the set-top control unit **110** transmits an IR signal **114** to the Cable set-top box **200** and the Cable set-top box **200** tunes its internal tuner to the channel. The channel is passed to the set-top control unit **110** by either the RF, composite, or s-video outputs. The set-top control unit **110** must be configured to receive the channel from its RF, composite, or s-video inputs. If the RF input is selected, the Set-top control unit **110** must also tune its internal tuner **640** (see Figure **2**) to either channel 3 or 4, depending upon which channel the cable box **200** is configured to receive the signal.

If the signal source **202** is from cable and the user has a digital cable set-top box **200**, the cable **118** is connected to the digital cable set-top box **200**. Note that in certain embodiments, the cable may be fiber optic. In certain other embodiments, the cable may be coaxial cable. The digital cable set-top box **200** contains an internal tuner that will be tuned to the channel the viewer wishes to view or record. The cable set-top box **200** connects **118** to the set-top control unit **110** in one of two ways. 1) The selected channel is modulated on either channel 3 or 4 and output on a RF connector. The RF connector is connected to the RF input connector on the Set-top control unit **110**. And the internal tuner in the Set-top control unit **110** is tuned to channel 3 or 4 to receive the channel. 2) The channel selected is output on either a composite or s-video connectors. These

connectors are connected to composite or s-video inputs on the Set-top control unit **110**. Using the s-video connectors in certain embodiments provides the highest quality connection.

The viewer selects which channel to tune to by using the TiVo Remote Control Unit **120**. After the selection is made, the Set-top control unit **110** transmits **114** an IR signal to the digital cable set-top box **200** and the digital cable set-top box **200** tunes its internal tuner to the channel. The channel is passed **118** to the TiVo set-top unit **110** by either the RF, composite, or s-video outputs. The TiVo set-top unit **110** must be configured to receive **118** the channel from its RF, composite, or s-video inputs. If the RF input is selected, the Set-top control unit **110** must also tune its internal tuner **640** (see Figure **2**) to either channel 3 or 4, depending on which channel the digital cable box **200** is configured to receive the signal.

If the signal source **202** is from a satellite antenna, the satellite receiver digital set-top box **200** is connected **118** to the Set-top control unit **110** in an identical fashion as described above for a digital cable set-top box **200**. As many satellite receivers also require a cable or terrestrial broadcast antenna to receive local channels, the preferred connection for a satellite receiver is using the s-video connectors in certain embodiments for the highest quality connection. Such connection also leaves the RF input connection on the Set-top control unit **110** free to attach cable or roof-top antenna to receive local channels.

Some digital satellite receivers support serial data ports. If so, rather than use IR to control the satellite receiver set-top box **200**, the serial output port **508** (see Figure **2**) on the Set-top control unit **110** can be connected **114** to the serial data port on the satellite receiver.

If the signal source **202** is from a digital terrestrial antenna and the digital terrestrial set-top box **200** provides an option to output standard NTSC compatible video on either RF, composite, or s-video outputs. Then one of these outputs can be connected **118** to the corresponding input on the Set-top control unit **110**. The digital terrestrial set-top box **200** is connected **118** to the Set-top control unit **110** in an identical fashion as described above for a digital cable set-top box **200**. The connection **118** using s-video provides the highest quality connection in certain embodiments.

Certain embodiments provide server based services through modem access **116**. Certain further embodiments provide server based services that include TiVo™ Services through modem access **116**.

Certain further embodiments support at least some of the following features: Records television programming in digital form on at least one internal hard disk drive. Certain further embodiments support 14 hours of recorded programming and certain other further embodiments support 30 hours of programming. Certain embodiments support digital recording of audio-video content including random access to titled programming. Certain further embodiments support digitally accurate fast forward, rewind, slow motion, frame forward, frame back and high-quality freeze frame. Certain embodiments provide a 30 minute buffer of live programming being viewed enabling view to pause, rewind and fast forward live TV.

Certain embodiments provide instant replay of live or recorded sporting events and educational programs. Certain embodiments provide a bookmarking feature to record to save the rest of a current program being watch to view later. Certain embodiments provide programmable scheduling by time and channel, just like a VCR. Certain embodiments allow viewers to save recorded programs to their VCRs. Certain embodiments provide selectable recording quality.

Certain embodiments provide a RF input **644** with tuner **640**, which is compatible with cable and terrestrial broadcast TV (see Figure **2**). Certain embodiments provide selectable RF input on channel 3, RF input on channel 4, composite or S-Video input support for analog cable, digital cable, or satellite set-top boxes.

In certain embodiments, a set-top control unit **110** electronics are housed in a metal enclosure approximately 17 inch wide, 13 inches deep and 4 inches high. The receiver supports one disk drive, providing up to 14 hours of program storage. In certain other embodiments, a 30 hour model of Set-top control unit **110** is identical to the 14 hour model except it supports two disk drives, providing up to 30 hours of program storage.

Television **130** is fed **132** from set-top control unit **110** in certain embodiments. In certain further embodiments, connection **132** feeds signals from a composite video output **550** (see Figure **2**) of set-top control unit **110**. In certain other further embodiments,

connection **132** feeds signals from an S-video output **548** (see Figure **2**) of set-top control unit **110**.

In certain embodiments, remote control unit **120** provides a wireless **122** control television **130**.

Figure **2** depicts a system block diagram set-top control unit **110** in accordance with certain embodiments.

In certain embodiments, the electronics of set-top control unit **110** consists of a main System Board **400**, an IR Controller Board (IR Ctrl) **620**, a mass storage system **600**, a Fan, and a Power Supply. Set-top control unit **110** supports one left-right stereo pair audio input **532-534**, one composite video input **522**, one S-Video input **524**, one RF input **644** and one RF output **642** modulated onto either channel 3 or 4.

Mass storage system **600** may include one or two IDE Disk Drives in certain embodiments. Set-top control unit **110** mass storage system **600** supports 1 or 2 IDE disk drives providing storage for up to 30 hours of programming.

The set-top control unit **110** provides at least one left-right stereo pair audio outputs **544-546**, at least one composite video output **550**, at least one S-Video output **548**, at least one serial input/output **508**, at least one IR blaster output **622**, and at least one modem input/output **510** which may be connected **116** to an associated phone line in certain embodiments. In certain further embodiments, a 33.3Kbit modem is used.

The electronics within the area denoted by **400** is located on the System Board. The IR Controller Board (IR Ctrl) **620** is manufactured as part of the System Board, detached during assembly, and electrically connected with a ribbon cable. This allows the IR Controller board **620** to be physically attached to the front panel of the enclosure. The disk drive(s) in mass storage system **600** are connected by a ribbon cable **564** to the System Board **400**. The Fan is connected to the System Board **400** with a cable **562**. The Power Supply is connected to the System Board **400** and mass storage system **600** with power cables.

The system board **400** can be generally divided into 1) subsystems that convert analog video and audio from analog to digital data, 2) subsystems that process digital audio and video data, and 3) subsystems that convert digital data back to analog.

The Tuner subsystem **640** and video and audio input subsystem **620** accept as input standard analog video and audio signals from set-top boxes, roof-top antennas, or rabbit ear antennas. The video and audio input subsystem **620** converts these signals into digital media streams.

The digital media streams **536** and **502** are processed and stored in the mass storage system **600** by Media Switch **560** and Processor Subsystems **500**. Media streams **542** selected by the user to view are retrieved **564** from the mass storage system **600** by the Media Switch **560** and Processor Subsystem **500**. Retrieved media stream **542** is converted from digital to analog by the Video and Audio Output Subsystem **540**. Media Switch **560** and Processor Subsystem **500** also perform miscellaneous house keeping functions such as temperature monitoring and fan control **562**. The Security Microprocessor **580** performs system identification and authentication for security purposes.

The System Board partitions into CPU, Input, and Output Subsystems. Each subsystem will be discussed in more detail below.

The Processor subsystem **500** includes the following in certain embodiments. The CPU is an IBM Power PC. The boot ROM is a 1 mega-bit Flash. The main memory is 4 meg x 32-bit, implemented using two 4096kx16-bit EDO RAMs. The IBM serial port is multiplexed to interface to the IR Controller Board and the Security Microprocessor. A second serial UART implements the external serial port that controls DSS Receivers. The modem is implemented with a Rockwell chipset and has an attached 1 mega-bit Flash that contains its microcode. The Media Switch ASIC controls multimedia streams to and from the disk drive. It also implements a number of system functions including the IDE disk drive controller, fan control and i2C bus control. The CPU Subsystem has a battery backed-up real-time clock and a temperature sensor interfaced to the i2C bus. The i2C bus is also used to control **502** Video and Audio Input system **620** and to control **506** Video and Audio Output Subsystem **540**.

The Video and Audio Input Subsystem **620** inputs video and audio from I/O connectors, converts it from analog to digital and encodes it using MPEG2 compression. Channel selection is performed with a tuner **640** when the RF input is selected. The video and audio are converted from analog to digital and then passed to a compression engine. In certain embodiments, only one video/audio source can be selected at a time to be processed by the compression engine.

The video compression is performed with an MPEG encoder chip set in certain embodiments. In certain embodiments, an MPEG encoder chip set coupled with RAM memories performs video compression. In certain further embodiments, the MPEG encoder chip set is composed of exactly one integrated circuit. A Sony MPEG2 encoder chip performs video compression in certain further embodiments. A DSP is used in certain embodiments to perform audio compression. In certain further embodiments, a DSP from Analog Devices is used to perform audio compression.

The Video and Audio Output Subsystem **540** decompresses video and audio cached on mass storage system **600**, converts it back into analog signals, and drives the output connectors. Certain embodiments of set-top control unit **110** support at least one stereo pair of audio output, at least one composite video outputs, at least one S-Video output and at least one RF output modulated onto either channels 3 or 4. Certain further embodiments of set-top control unit **110** support at least two stereo pair of audio output and at least two composite video outputs.

The compressed video/audio stream **542** is transferred to an MPEG2 decoder chip set for decoding in certain embodiments. In certain further embodiments the MPEG decoder chip set is coupled to RAM memory. The compressed video/audio stream **542** is transferred to an IBM MPEG2 decoder chip with coupled RAM memory for decoding in certain further embodiments.

The uncompressed digital video, output by the MPEG decoder chip set, is sent to a video encoder to convert the video back into analog form before driving the video output connectors in certain embodiments. In certain further embodiments, a Phillips video encoder chip performs the conversion. Audio is mixed with user interface sound effects before driving the audio output connectors in certain embodiments. Audio is converted

from digital into analog and then mixed with user interface sound effects before driving the audio output connectors in certain further embodiments.

The IR Controller Board **620** contains an IR Microcontroller, an IR Photo receiver module, and LED's indicators. IR controller board **620** is connected **514** to the System Board with a ribbon cable that connects the IR Microcontroller to the Power PC using the Power PC's serial port in certain embodiments.

Set-top control unit **110** mass storage system **600** supports two disk drive bays in certain embodiments. The 14 hour Set-top control unit **110** has one 3-1/2 inch IDE disk drives in its mass storage system **600**, supporting up to 14 hours of programming. The 30 hour Set-top control unit **110** has one or two 3-1/2 inch IDE disk drives in its mass storage system **600**, supporting up to 30 hours of programming. The power for the disk drives is connected directly from the power supply. The IDE interfaces of the drives are connected **564** to the System board with a flat ribbon cable.

Note that in certain embodiments, IR control codes are stored in an IR control code database **1100** (see Figure **3**) residing on mass storage system **600**.

Figure **3** depicts data flow regarding IR control of external set-top boxes in accordance with certain embodiments.

In certain embodiments, IR control database **1100** resides on the mass storage system **600** and contains at least one IR control entry. A first IR control entry is accessed **1102** to IR control generator **1110**. IR control generator **1110** processes the IR control entry and sends **1112-1122** it to be prepared **1130** for presentation **1132** to a serial device **1140**. Serial device **1140** serially transmits this presented information as control signals to an external set-top box.

In certain further embodiments, timing generation **1120** is performed before **1122** it is prepared **1130** for presentation **1132** to a serial device **1140**. In certain embodiments, preparation **1130** includes processing similar to the "C" programming language function "sprintf". In certain further embodiments, preparation **1130** includes multiplexing serial streams to be sent to serial device **1140**. In certain further embodiments, preparation **1130** includes queuing various multiplexed serial streams to be sent to serial device **1140**.

In certain embodiments, the serial device **1140** includes at least one IR controller. In certain further embodiments, the serial device **1140** further includes a second serial device physical transport layer, which may include either wireline or wireless transport mechanisms.

In certain embodiments, raw IR control library **1180** resides on the mass storage system **600** and contains at least one raw IR control entry. A first raw IR control entry is accessed **1182** by a library parsing operation **1190** to create a processed first IR control entry. The processed first IR control entry is communicated **1192** and received **1192** to create a received first IR control entry. The received first IR control entry is inserted into IR control database **1100** as an IR control entry of the IR control database **1100**.

In certain further embodiments, first raw IR control entry is accessed **1182** by a library parsing operation **1190** to create a processed first IR control entry syntactic specification. The processed first IR control entry syntactic specification is communicated **1192** and received **1192** to create a received first IR control entry.

Syntactic specifications provide for the specification of many crucial forms of communication information in an IR control entry. This includes but is not limited to specification of how many digits are in a channel. This also includes but is not limited to specifying whether an enter or cancel key is used at the end of IR blasting sequence to delimit channels. This also includes but is not limited to specifying delays between transmission of digits or symbols. This also includes but is not limited to specifying prefix keys. Prefix keys are not digits, which may used to delimit switch settings in certain embodiments. Many set-top boxes have an A/B switch, often with channels on both A and B switch settings. Some set-top boxes supporting satellite reception further have a C-band switch setting. This also includes but is not limited to specifying postfix keys. Postfix keys are not digits which alter the interpretation of the preceding IR blasting sequence.

Note that a syntactic specification may be the entire IR control entry, or a part of the entry.

This also includes but is not limited to syntactic specifying IR control entries further referencing other syntactic specifying IR control entries. This supports development of complex blasting codes to perform essentially macro operations.

In certain further embodiments, the first raw IR control entry is accessed **1184** by raw data IR generator **1200** to create a raw IR control packet, which processes the raw IR control packet and sends **1202-1122** it to be prepared **1130** for presentation **1132** to a serial device **1140**. Serial device **1140** serially transmits this presented information as control signals to an external set-top box.

In certain further embodiments, timing generation **1120** is performed before **1122** it is prepared **1130** for presentation **1132** to a serial device **1140**. In certain embodiments, preparation **1130** includes processing similar to the "C" programming language function "sprintf". In certain further embodiments, preparation **1130** includes multiplexing serial streams to be sent to serial device **1140**. In certain further embodiments, preparation **1130** includes queuing various multiplexed serial streams to be sent to serial device **1140**.

In certain embodiments, a prototype IR control database **1150** resides on mass storage system **600** containing at least one prototype IR control entry. A control code search **1160** accessing **1152** a first prototype IR control entry creates a first raw IR control entry for raw IR control library **1180**. In certain further embodiments, the first prototype IR control entry is accessed **1154** by timing interface **1160** to create a first IR control packet, which then follows the same data flow **1122** as has been previously described. Note that in certain further embodiments, the prototype IR control database is compatible with the PRONTO device database, based upon the PRONTO products manufactured by Philips.

Figure **4** depicts a refinement of Figure 1 regarding IR control of external set-top boxes in accordance with certain embodiments. Note that the entire discussion regarding Figure **3** is applicable to this figure and will not be repeated to simplify and focus the discussion on the additional elements of this figure.

In certain embodiments, corrections-additions database **1210** resides on mass storage **600** and may contain a first correction entry. In addition to the first raw IR control entry being accessed **1182** by library parsing operation **1190** to create a processed first IR control entry, there are additional activities in certain further embodiments. A first raw IR

control entry is accessed **1182** and a first correction entry is accessed **1212** by a library parsing operation **1190** to create a processed IR control entry. This processed IR control entry may replace the processed first IR control entry which was generated based strictly upon accessing **1182** the raw IR control library **1180**. This processed IR control entry may be in addition to the processed first IR control entry which was generated based strictly upon accessing **1182** the raw IR control library **1180**.

Figure **5** depicts a system controlling a set-top box using a prototype test unit in accordance with certain embodiments.

This figure is a refinement of Figure **1**, and shares all of the discussion of Figure **1**. As such that discussion will not be repeated and the focus herein will be on the interaction of the new element, a prototype test unit **140** which is coupled **142** to an implementation of set-top control unit **110** and further coupled **144** to the IR control unit **120**.

In certain embodiments, a new IR control unit **120** may be encountered which possesses a distinctive control signaling protocol. Prototype test unit **140** receives the IR blasted codes from the remote control unit **120**, which it then formats and enters into the prototype IR control database **1150** (see Figures **3** and **4**). Through a procedure of successive experimental steps, the IR control codes necessary to fully interface with the remote control unit **120** are discerned and entered into the prototype IR control database **1150**. Line **116** may then be used to transmit this updated or new information to other systems including set-top control units **110**, or servers, which in turn may distribute such updated or new information to other systems including set-top control units **110**.

Note that in almost all cases today, new set-top box units are shipped with a hand held remote control unit **120** which is specifically configured to work with the new set-top box unit. A user of a set-top box control unit as depicted in Figure **1** need only ship the hand held IR control unit **120** to a central site containing a system as in this figure. The system as shown in this figure determines the specific IR control signaling needed to interface with the new set-top box. The communication line **116** of the consumer unit of Figure **1** is then utilized to download the newly determined specific IR control signaling necessary to control their new set-top box unit.

Figure **6** depicts a network with server system **104**, a prototype set-top control system **102** and multiple set-top control systems **100-1** to **100-4**.

Continuing the discussion from the previous figure, this figure depicts an embodiment of the invention wherein multiple set-top control systems **100-1** to **100-4** share the advantages of access to prototype set-top control system **102**. In certain embodiments, server system **104** may only act to distribute updates on a data entry by data entry level. In certain further embodiments server system **104** may store the entire IR control database for downloading by any of the **100** systems.

Figure **7** depicts a hand held remote control unit **120** in accordance with certain embodiments.

Note that the remote control **120** specification is detailed in a document entitled "Remote Control Specification SRCU-00001-000 A" which is included as appendix A herein.

Although the invention is preferably described herein with reference to the preferred embodiment, one skilled in the art will readily appreciate that other applications may be substituted for those set forth herein without departing from the spirit and scope of the present invention. Accordingly, the invention should only be limited by the Claims included below.

# Appendix A

## CODELIST - Manufacturers Code Number Assignments

**Table 13: TV**

| Maker (Brand) Name | Code Number (4 digit) List |
|---|---|
| A MARK | 0091 0119 |
| AKAI | 0001 0144 |
| AMPRO | 0062 0151 |
| AMSTRAD | 0046 |
| ANAM | 0038 0048 0050 0068 0083 0087 0091 0097 .0100 |
| AOC | 0001 0004 0091 |
| BLAUPUNKT | 0074 |
| CANDLE | 0001 0002 0003 0004 |
| CAPEHART | 0052 |
| CETRONIC | 0038 |
| CITIZEN | 0001 0002 0003 0004 0038 0080 0082 0119 |
| CLASSIC | 0038 |
| CONCERTO | 0004 |
| CONTEC | 0035 0038 0044 0045 |
| CORONADO | 0119 |
| CRAIG | 0038 0042 0048 0136 0137 |
| CROWN | 0038 0119 |
| CURTIS MATHES | 0001 0004 0080 0119 |
| CXC | 0038 |
| DAEWOO | 0004 0015 0016 0031 0038 0039 0049 0060 0065 0082 0086 0090 0093 0096 0099 0102 0104 0107 0114 0119 |
| DAYTRON | 0004 0119 |

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**Table 13: TV**

| Maker (Brand) Name | **Code Number (4 digit) List** |
|---|---|
| DYNASTY | 0038 |
| DYNATECH | 0056 |
| ELECTROHOME | 0023 0119 |
| EMERSON | 0001 0004 0005 0026 0038 0041 0042 0044 0045 0079 0119 0123 0124 0125 0136 0146 |
| FISHER | 0006 0051 |
| FUNAI | 0026 0038 |
| FUTURETECH | 0038 |
| GE | 0001 0004 0007 0008 0031 0050 0062 0063 0109 0120 0125 0127 0134 0148 |
| GOLDSTAR | 0004 0081 0091 0101 0119 |
| HALL MARK | 0004 |
| HITACHI | 0001 0004 0006 0008 0009 0010 0011 0022 0036 0064 0119 0126 |
| INFINITY | 0129 |
| INKEL | 0108 |
| JBL | 0129 |
| JCPENNY | 0001 0004 0007 0008 0023 0028 0080 0119 0127 |
| JENSEN | 0012 |
| JVC | 0031 0033 0071 |
| KEC | 0038 |
| KENWOOD | 0001 |
| KLOSS | 0002 0053 |
| KMC | 0119 |
| KTV | 0001 0038 0119 0146 |
| LODGENET | 0061 |

**Table 13: TV**

| Maker (Brand) Name | Code Number (4 digit) List |
|---|---|
| LOGIK | 0061 |
| LUXMAN | 0004 |
| LXI | 0006 0014 0046 0069 0127 0129 |
| MAGNAVOX | 0001 0003 0004 0053 0054 0055 0057 0058 0119 0127 0129 |
| MARANTZ | 0001 0023 0129 |
| MATSUI | 0129 |
| MEMOREX | 0004 0006 0061 |
| METZ | 0074 |
| MGA | 0001 0004 0023 0026 0037 0043 |
| MINERVA | 0074 |
| MITSUBISHI | 0001 0004 0023 0026 0035 0037 0144 |
| NAD | 0014 0024 |
| NEC | 0001 0006 0015 0018 0023 0035 0050 0109 0113 |
| NIKEI | 0038 |
| ONKING | 0038 |
| ONWA | 0038 |
| OPTONICA | 0018 0069 |
| PANASONIC | 0031 0050 0068 0129 |
| PHILCO | 0001 0003 0004 0023 0038 0050 0053 0054 0057 0058 0119 0129 |
| PHILIPS | 0001 0003 0004 0033 0053 0059 0077 0119 0127 0129 |
| PIONEER | 0001 0004 0017 0022 0024 0025 |
| PORTLAND | 0004 0119 |
| PROSCAN | 0120 |

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**Table 13: TV**

| Maker (Brand) Name | Code Number (4 digit) List |
|---|---|
| PROTON | 0004 0052 0091 0119 0152 |
| QUASAR | 0031 0050 |
| RADIO SHACK | 0004 0018 0038 0041 0119 |
| RCA | 0001 0004 0022 0023 0050 0063 0120 0127 0145 0148 |
| REALISTIC | 0006 0018 0038 0041 |
| RUNCO | 0109 |
| SAMPO | 0001 0004 0052 |
| SAMSUNG | 0004 0044 0075 0080 0084 0112 0119 0127 |
| SANYO | 0006 0019 0020 0030 0035 0047 0051 0070 |
| SCOTT | 0004 0026 0038 0042 0119 |
| SEARS | 0004 0006 0014 0026 0028 0051 0070 0080 0119 0127 |
| SHARP | 0004 0013 0018 0021 0026 0069 0119 |
| SIEMENS | 0074 |
| SIGNATURE | 0061 |
| SONY | 0036 0059 0067 0105 0138 |
| SOUNDESIGN | 0003 0004 0026 0038 |
| SPECTRICON | 0091 |
| SSS | 0004 0038 |
| SUPRE MACY | 0002 |
| SYLVANIA | 0001 0003 0004 0053 0054 0057 0058 0119 0127 0129 |
| TANDY | 0069 |
| TATUNG | 0050 0056 |
| TECHNICS | 0072 |

**Table 13: TV**

| Maker (Brand) Name | **Code Number (4 digit) List** |
|---|---|
| TECHWOOD | 0004 |
| TEKNIKA | 0001 0002 0003 0004 0023 0026 0029 0038 0061 0080 0082 0119 |
| TELEFUNKEN | 0032 0040 0073 0142 |
| TELERENT | 0061 |
| TERA | 0133 |
| TMK | 0004 |
| TOSHIBA | 0006 0014 0028 0035 0045 0056 0080 |
| TOTEVISION | 0119 |
| UNIVERSAL | 0007 0008 |
| VIDEO CONCEPTS | 0144 |
| VIDTECH | 0004 |
| WARDS | 0004 0007 0008 0018 0026 0054 0055 0057 0058 0061 0063 0119 0129 |
| YAMAHA | 0001 0004 |
| YORK | 0004 |
| YUPITERU | 0038 |
| ZENITH | 0061 0062 0078 0082 |
| ZONDA | 0091 |

## Appendix A

**Table 14: AUDIO**

| Maker (Brand) Name | Code Number (4 digit) List |
|---|---|
| ADCOM | 1068 1078 1122 |
| AIWA | 1013 1045 1089 1116 1117 |
| AKAI | 1106 |
| ANAM | 1016 1154 1155 |
| B&K | 1082 |
| BOSE | 1109 |
| CARVER | 1008 1024 1026 1046 1052 1123 |
| CLARION | 1023 |
| DENON | 1003 1029 1127 |
| ENLIGHTENED | 1085 |
| EVERQUEST | 1022 |
| FISHER | 1008 1026 1063 |
| FOSGATE AUDIONIC | 1128 |
| GOLDSTAR | 1010 1158 |
| HARMAN KARDON | 1128 |
| HITACHI | 1017 1168 |
| INKEL | 1107 |
| JCPENNY | 1009 1087 |
| JENSEN | 1049 |
| JVC | 1011 |
| KENWOOD | 1023 1107 1112 |
| LEXICON | 1103 1130 1132 1133 |
| LOTTE | 1157 1159 |
| LUXMAM | 1030 |

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Table 14: AUDIO

| Maker (Brand) Name | Code Number (4 digit) List |
|---|---|
| LXI | 1064 |
| MAGNAVOX | 1024 1072 |
| MARANTZ | 1024 1035 1047 1053 1055 1073 |
| MCINTOSH | 1134 |
| MCS | 1009 |
| MITSUBISHI | 1138 |
| NAD | 1025 |
| NAKAMICHI | 1035 1140 |
| NILES | 1141 |
| ONKYO | 1014 1039 1092 1093 1099 1149 |
| OPTIMUS | 1019 1023 1036 |
| PANASONIC | 1007 1028 1074 1160 1166 |
| PHILIPS | 1024 1073 1145 |
| PIONEER | 1001 1034 1040 1059 1076 |
| QUASAR | 1007 1074 |
| RCA | 1042 1101 |
| REALISTIC | 1002 1004 1016 1020 1064 1081 |
| ROTEL | 1061 1069 1071 |
| SAMSUNG | 1163 1164 1165 |
| SANSUI | 1024 1035 1095 1102 |
| SANYO | 1153 |
| SCOTT | 1016 1077 |
| SHARP | 1023 1048 1080 1111 1112 1169 |
| SHERWOOD | 1021 1033 |
| SONY | 1045 1070 1086 1120 1143 |

## Appendix A

**Table 14: AUDIO**

| Maker (Brand) Name | Code Number (4 digit) List |
|---|---|
| SOUNDESIGN | 1031 |
| SSI | 1058 |
| TAEKWANG | 1106 1152 1161 |
| TEAC | 1016 1050 1051 1156 |
| TECHNICS | 1007 1074 1088 1094 1104 1115 |
| TOSHIBA | 1097 |
| VICTOR | 1011 1091 |
| YAMAHA | 1018 1023 1027 1057 1148 1167 |
| ZANTEK | 1147 |

**Table 15: VCR**

| Maker (Brand) Name | Code Number (4 digit) List |
|---|---|
| ADMIRAL | 2046 |
| AIWA | 2030 |
| AKAI | 2014 2037 2039 2098 2112 |
| AMPRO | 2065 |
| ANAM | 2027 2029 2078 |
| AUDIO DYNAMICS | 2010 2020 2034 2037 |
| BROKSONIC | 2031 2033 2099 |
| CANON | 2024 2027 2029 |
| CAPEHART | 2083 |
| CRAIG | 2002 2035 2105 |
| CURTIS MATHES | 2027 2029 |
| DAEWOO | 2004 2006 2009 2015 2058 2083 2085 2086 |
| DAYTRON | 2083 |
| DBX | 2010 2020 2034 2037 |
| DYNATECH | 2030 2046 |
| ELECTROHOME | 2052 |
| EMERSON | 2005 2015 2022 2023 2025 2027 2030 2031 2032 2033 2039 2076 2099 2101 2108 |
| FISHER | 2002 2007 2009 |
| FUNAI | 2030 |
| GE | 2027 2029 2056 2065 2082 2084 2110 2113 |
| GO VIDEO | 2102 |
| GOLDSTAR | 2010 2011 2017 2076 2089 2096 |
| HARMAN KARDON | 2010 2038 |
| HITACHI | 2011 2030 2037 2056 2116 |

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**Table 15: VCR**

| Maker (Brand) Name | Code Number (4 digit) List |
|---|---|
| INSTANTREPLAY | 2027 2029 |
| JCL | 2027 2029 |
| JCPENNY | 2010 2011 2027 2029 2035 2076 |
| JENSEN | 2037 |
| JVC | 2010 2027 2029 2037 2041 2053 2100 2116 2118 |
| KENWOOD | 2010 2012 2034 2037 2041 |
| LLOYD | 2030 |
| LXI | 2011 2012 2030 2076 |
| MAGIN | 2035 |
| MAGNAVOX | 2027 2029 2030 2060 2061 |
| MARANTZ | 2010 2027 2029 2060 2062 |
| MARTA | 2076 |
| MATSUI | 2023 2026 |
| MEI | 2027 2029 |
| MEMOREX | 2002 2009 2012 2027 2029 2030 2046 2065 2076 2104 2109 |
| MGA | 2038 2039 2052 |
| MINOLTA | 2011 2017 |
| MITSUBISHI | 2011 2017 2038 2039 2042 2044 2052 2054 |
| MULTITECH | 2021 2030 |
| NEC | 2010 2020 2034 2037 2041 |
| NORDMENDE | 2037 |
| OPTONICA | 2046 2047 |
| PANASONIC | 2027 2063 2067 2103 |
| PENTAX | 2011 2017 2027 2029 2056 |
| PHILCO | 2027 2029 2030 2060 |

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**Table 15: VCR**

| Maker (Brand) Name | Code Number (4 digit) List |
|---|---|
| PHILIPS | 2027 2029 2030 2047 2060 2064 2076 |
| PILOT | 2076 |
| PIONEER | 2011 2018 2041 |
| PORTLAND | 2083 |
| PROSCAN | 2088 |
| PULSAR | 2065 |
| QUARTZ | 2001 2012 |
| QUASAR | 2027 2029 |
| RCA | 2011 2017 2027 2029 2056 2082 2084 2088 2110 2113 |
| REALISTIC | 2002 2007 2009 2012 2027 2029 2030 2035 2046 2047 2076 |
| RICO | 2051 |
| RUNCO | 2065 |
| SALORA | 2012 |
| SAMSUNG | 2015 2028 2035 2080 2082 2084 2088 2090 2098 |
| SANSUI | 2037 2041 2105 |
| SANYO | 2002 2006 2009 2012 2104 |
| SCOTT | 2015 2033 2088 2099 2101 |
| SEARS | 2002 2007 2009 2011 2012 2017 2027 2076 |
| SHARP | 2027 2046 2047 |
| SHINTOM | 2021 |
| SIGNATURE 2000 | 2046 |
| SONY | 2002 2027 2045 2046 2049 2050 2051 |
| SOUNDESIGN | 2030 |
| STS | 2011 |
| SYLVANIA | 2027 2029 2030 2052 2060 |

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**Table 15: VCR**

| Maker (Brand) Name | Code Number (4 digit) List |
|---|---|
| SYMPHONIC | 2030 |
| TANDY | 2009 2030 |
| TATUNG | 2010 2034 2037 |
| TEAC | 2010 2030 2034 2037 |
| TECHNICS | 2027 2029 |
| TEKNIKA | 2016 2027 2029 2030 2076 |
| THOMAS | 2030 |
| TMK | 2005 |
| TOSHIBA | 2007 2011 2015 2052 2074 2101 2116 |
| TOTEVISION | 2035 2076 |
| UNITECH | 2035 |
| VECTOR RESEARCH | 2010 |
| VICTOR | 2041 |
| VIDEO CONCEPTS | 2010 2030 2039 |
| VIDEOSONIC | 2035 |
| WARDS | 2002 2011 2015 2021 2027 2029 2030 2035 2046 2047 2101 |
| WORDS | 2065 |
| YAMAHA | 2010 2030 2034 2037 |
| ZENITH | 2030 2041 2049 2051 2065 2072 2076 |

Claims

1. A method for providing control of a set-top box with infrared (IR) signals, comprising the steps of:

providing an IR control database residing on a mass storage system, wherein said IR control database contains at least one IR control entry;

providing an IR control packet, wherein said IR control packet is generated from a first IR control entry of said IR control database; and

controlling said set-top box with said IR control packet.

2. The method of Claim 1, further comprising the steps of:

generating said IR control packet containing an IR control waveform from an IR waveform specification of said first IR control entry; and

transmitting said IR control packet, based upon said IR control waveform, to said set-top box;

wherein said first IR control entry of said IR control database contains said IR waveform specification.

3. The method of Claim 2, wherein said transmitting step further comprises providing multiplexed serial transmission of said IR control packet based upon said IR control waveform to said set-top box.

4. The method of Claim 2, wherein said transmitting step further comprises providing queued multiplexed serial transmission of said IR control packet based upon said IR control waveform to said set-top box.

5. The method of Claim 1, further comprising the steps of:

receiving an IR control entry to create a received IR control entry; and

inserting said received IR control entry to create said first IR control entry of said IR control database.

6. The method of Claim 5, further comprising the steps of:

providing a raw IR control library residing on said mass storage system, wherein said raw IR control library contains a first raw IR control entry;

parsing said first raw IR control entry of said raw IR control library to create a processed first IR control entry; and

communicating said processed first IR control entry to create said first IR control entry of said IR control database.

7. The method of Claim 6, further comprising the step of:

providing a raw IR control packet, wherein said IR control packet is generated from said first raw IR control entry of said raw IR control library;

wherein said controlling step controls said set-top box by transmission of said raw IR control packet.

8. The method of Claim 6, further comprising the steps of:

providing a prototype IR control database residing on said mass storage system, wherein said prototype IR control database contains a first prototype IR control entry;

performing a control code search to access said prototype IR control database to select a first prototype IR control entry; and

generating from said first IR control entry said first raw IR control entry of said raw IR control library.

9. The method of Claim 8, further comprising the step of:

providing a timing interface wherein said first IR control packet is generated from said first prototype IR control entry of said prototype IR control database.

10. The method of Claim 6, further comprising the steps of:

providing a corrections-additions database residing on said mass storage system, wherein said corrections-additions database contains a first correction data entry; and

parsing said first correction data entry and said first raw IR control entry to create said processed first IR control entry.

11. The method of Claim 6, wherein said system contains a first computer and a second computer;

wherein said mass storage system contains a first mass storage system coupled to said first computer and a second mass storage system coupled to said second computer;

wherein said IR control database includes a first instance of said IR control database residing on said first mass storage system coupled to said first computer;

wherein said receiving step creates said received first IR control entry at said first computer;

wherein said insertion step inserts said received first IR control entry at said first computer to create said first IR control entry of said first instance of said IR control database residing on said first mass storage system;

wherein said raw IR control library resides on said second mass storage system containing said first raw IR control entry;

wherein said library parsing step creates said processed first IR control entry by said second computer; and

wherein said communication step communicates said processed first IR control entry by said second computer to create said first IR control entry of said IR control database.

12. The method of Claim 11, wherein said system further includes a server computer system;

wherein said receiving step creates a received first IR control entry by said server computer system: and

said communication step includes the steps of:

providing communication of said processed first IR control entry by said second computer to create said first IR control entry by said server computer system; and

providing communication of said processed first IR control entry by said server computer system to create said first IR control entry of said first instance of said IR control database by said first computer.

13. The method of Claim 6, wherein said first IR control entry of said IR control database includes a first IR control syntax specification.

14. The method of Claim 13, wherein said first IR control syntax specification includes a number of digits in a channel specification.

15. The method of Claim 13, wherein said first IR control syntax specification entry includes a delimiter specification ending an IR transmission.

16. The method of Claim 13, wherein said first IR control syntax specification entry includes a delay specification between digits of an IR transmission.

17. The method of Claim 13, wherein said first IR control syntax specification entry includes a prefix specification.

18. The method of Claim 17, wherein said prefix specification includes an A/B switch prefix selection.

19. The method of Claim 17, wherein said prefix specification includes an A/B/C switch prefix selection.

20. An apparatus for providing control of a set-top box with an IR signal, comprising:

a mass storage system;

an IR control database residing on said mass storage system wherein said IR control database contains at least one IR control entry;

an IR control packet, wherein said IR control packet is generated from a first IR control entry of said IR control database; and

a transmitter that controls said set-top box by transmitting said IR control packet thereto.

21. The apparatus of Claim 20, said IR control packet further comprising:

an IR control waveform based upon an IR waveform specification of said first IR control entry;

wherein said IR control packet is transmitted to said set-top box based upon said IR control waveform.

22. The apparatus of Claim 21, wherein said transmitter provides multiplexed serial transmission of said IR control packet to said sat-top box based upon said IR control waveform.

23. The apparatus of Claim 21, wherein said transmitter provides queued multiplexed serial transmission of said IR control packet to said set-top box based upon said IR control waveform.

24. The apparatus of Claim 20, further comprising:

means for comprising a received IR control entry based upon reception of an IR control entry; and

means for comprising said first IR control entry of said IR control database based upon insertion of said received IR control entry to create.

25. The apparatus of Claim 24, further comprising:

a raw IR control library residing on said mass storage system, wherein said raw IR control library contains a first raw IR control entry;

means for parsing said first raw IR control entry of said raw IR control library to create a processed first IR control entry; and

means for communicating said processed first IR control entry to create said first IR control entry of said IR control database.

26. The apparatus of Claim 25, further comprising:

a raw IR control packet, wherein said IR control packet is generated from said first raw IR control entry of said raw IR control library; and

wherein said control provides control to said set-top box by transmission of said raw IR control packet.

27. The apparatus of Claim 25, further comprising:

a prototype IR control database residing on said mass storage system containing a first prototype IR control entry;

means for performing a control code search access on said prototype IR control database to select a first prototype IR control entry; and

means for generating from said first IR control entry said first raw IR control entry of said raw IR control library.

28. The apparatus of Claim 27, further comprising:

a timing interface, wherein said first IR control packet is generated from said first prototype IR control entry of said prototype IR control database.

29. The apparatus of Claim 25, further comprising:

a corrections-additions database residing on said mass storage system, said corrections-additions database containing a first correction data entry; and

means for parsing said first correction data entry and of said first raw IR control entry to create said processed first IR control entry.

30. The apparatus of Claim 25, wherein said system further comprises a first computer and a second computer;

wherein said mass storage system further comprises a first mass storage system coupled to said first computer and a second mass storage system coupled to said second computer;

wherein said IR control database comprises a first instance of said IR control database residing on said first mass storage system coupled to said first computer;

wherein said receiving creates said received first IR control entry at said first computer;

wherein said insertion inserts said received first IR control entry at said first computer to create said first IR control entry of said first instance of said IR control database residing on said first mass storage system;

wherein said raw IR control library resides on said second mass storage system containing said first raw IR control entry;

wherein said library parsing creates said processed first IR control entry by said second computer; and

wherein said communication communicates said processed first IR control entry by said second computer to create said first IR control entry of said IR control database.

31. The apparatus of Claim 30,

wherein said system further comprises a server computer system;

wherein said receiving creates a received first IR control entry by said server computer system; and

wherein said communication comprises:

communication of said processed first IR control entry by said second computer to create said first IR control entry by said server computer system; and

communication of said processed first IR control entry by said server

computer system to create said first IR control entry of said first instance of said IR control database by said first computer.

32. The apparatus of Claim 25, wherein said first IR control entry of said IR control database comprises a first IR control syntax specification.

33. The apparatus of Claim 32, wherein said first IR control syntax specification comprises a number of digits in a channel specification.

34. The apparatus of Claim 32, wherein said first IR control syntax specification entry comprises a delimiter specification ending an IR transmitter.

35. The apparatus of Claim 32, wherein said first IR control syntax specification entry comprises a delay specification between digits of an IR transmitter.

36. The apparatus of Claim 32, wherein said first IR control syntax specification entry comprises a prefix specification.

37. The apparatus of Claim 36, wherein said prefix specification includes an A/B switch prefix selection.

39. The apparatus of Claim 36, wherein said prefix specification includes an A/B/C switch prefix selection.

39. A program storage medium readable by a computer, tangibly embodying a program of instructions executable by the computer to perform a method for controlling a set-top box with an IR signal, said method comprising the steps of:

providing an IR control database for residence on a mass storage system;

providing reception of an IR control entry to create a received IR control entry;

providing insertion of said received IR control entry to create said first IR control entry of said IR control database;

providing an IR control packet, wherein said IR control packet is generated from a first IR control entry of said IR control database;

providing control to said set-top box by serial transmission of said IR control packet;

providing a raw IR control library residing on said mass storage system, wherein said raw IR control library contains a first raw IR control entry;

parsing said first raw IR control entry of said raw IR control library to create a processed first IR control entry;

communicating said processed first IR control entry to create said first IR control entry of said IR control database;

providing a corrections-additions database residing on said mass storage system, wherein said corrections-additions database contains a first correction data entry; and

parsing said first correction data entry and said first raw IR control entry to create said processed first IR control entry, wherein said IR control database contains at least one IR control entry.

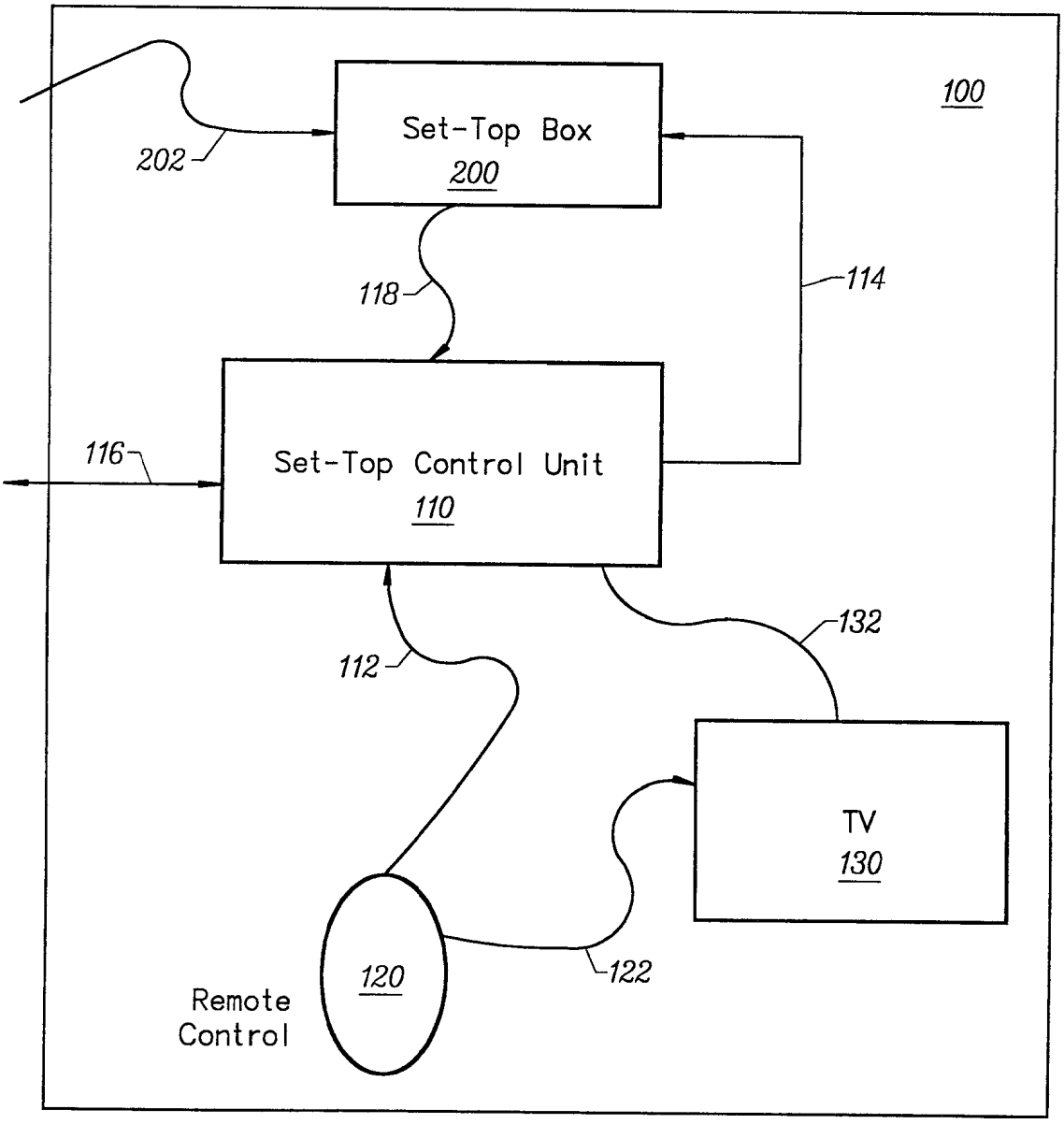
100
Set-Top Box
200
202
118
114
Set-Top Control Unit
110
116
112
132
TV
130
120
122
Remote
Control

FIG. 1

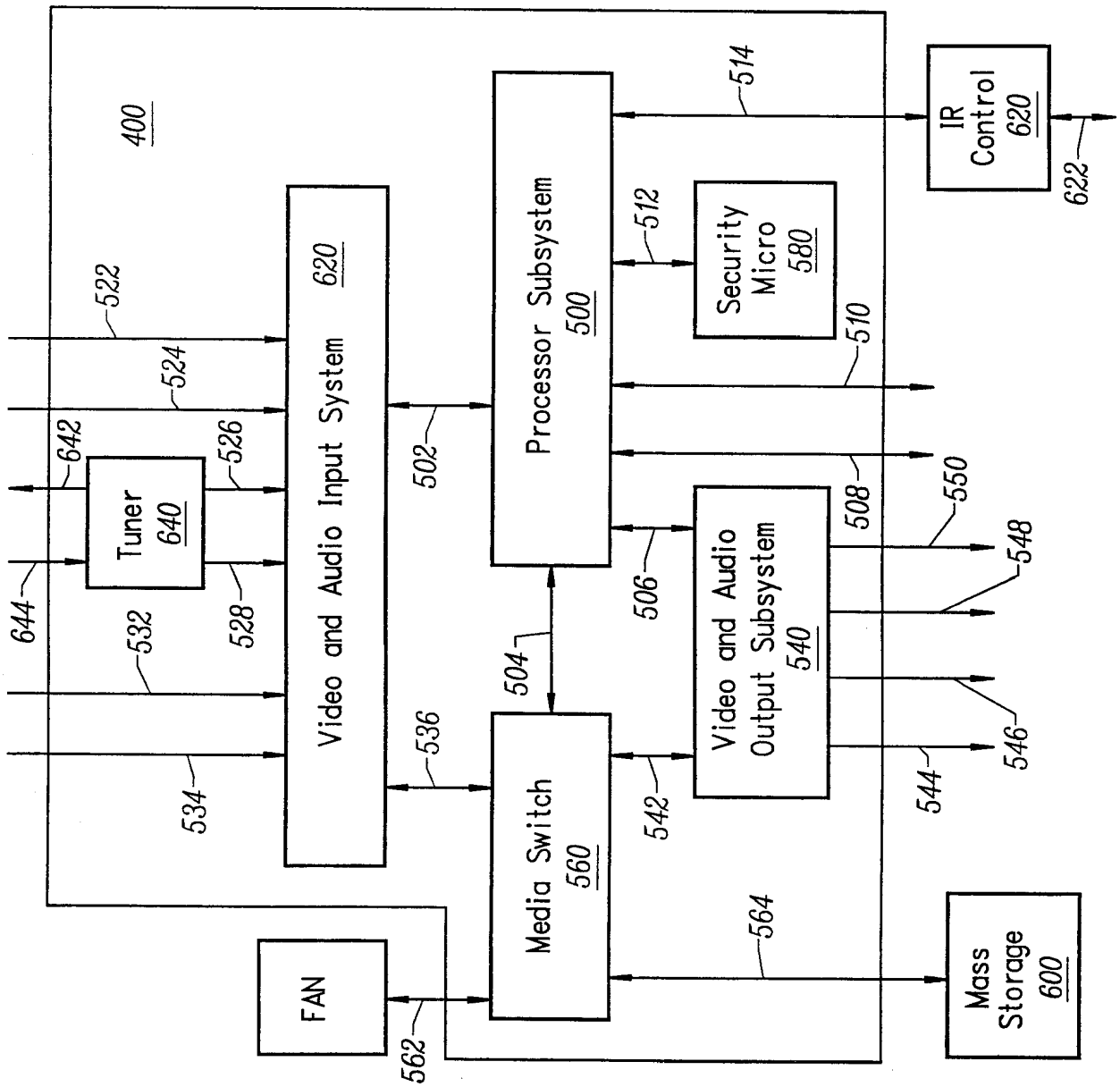
400
Video and Audio Input System 620
Tuner 640
Processor Subsystem 500
Security Micro 580
IR Control 620
Video and Audio Output Subsystem 540
Media Switch 560
FAN
Mass Storage 600
502
504
506
508
510
512
514
522
524
526
528
532
534
536
542
544
546
548
550
562
564
622
642
644

FIG. 2

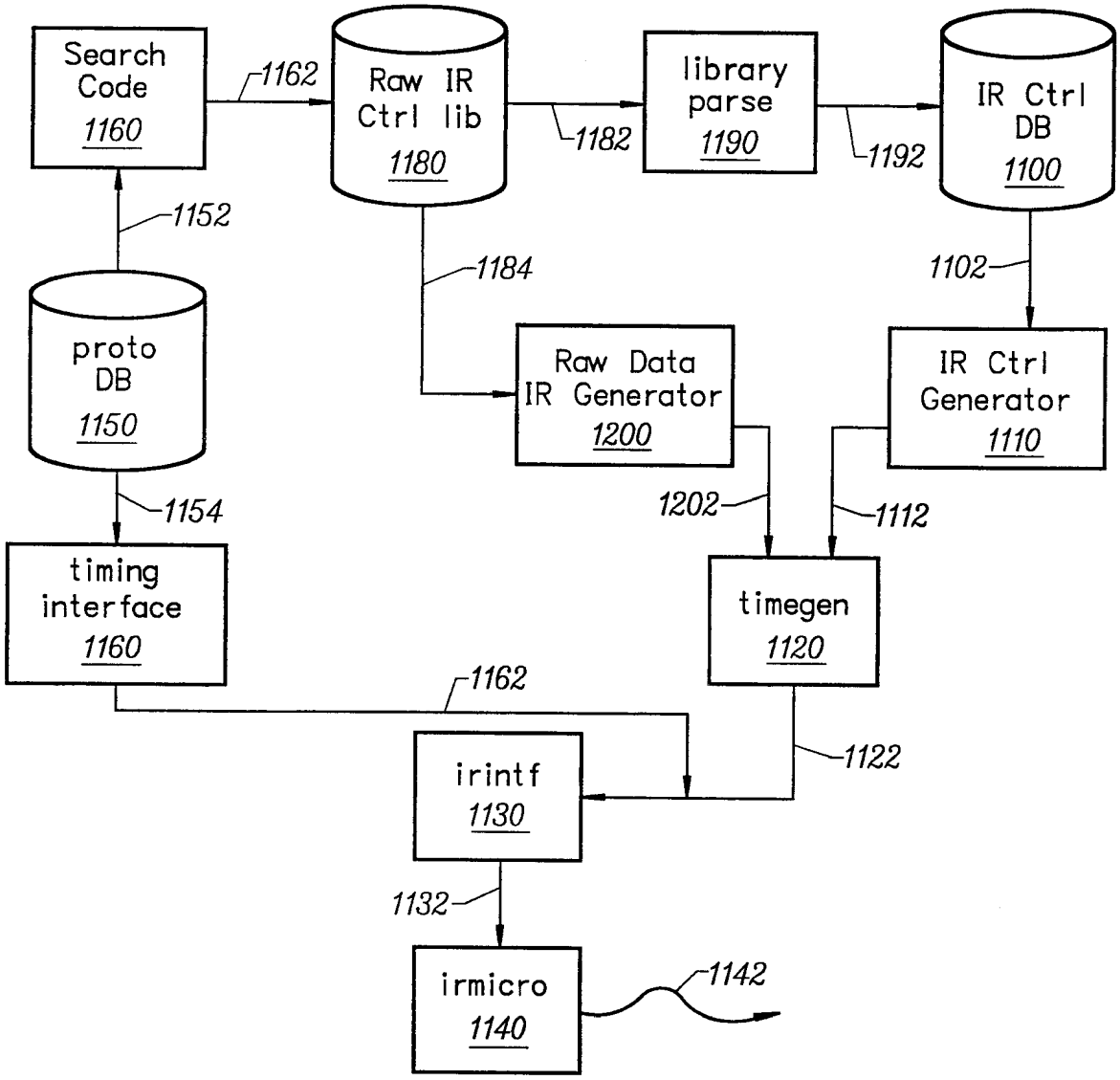
Search Code 1160
1162
Raw IR Ctrl lib 1180
1182
library parse 1190
1192
IR Ctrl DB 1100
1152
1184
1102
proto DB 1150
Raw Data IR Generator 1200
IR Ctrl Generator 1110
1154
1202
1112
timing interface 1160
timegen 1120
1162
1122
irintf 1130
1132
irmicro 1140
1142

FIG. 3

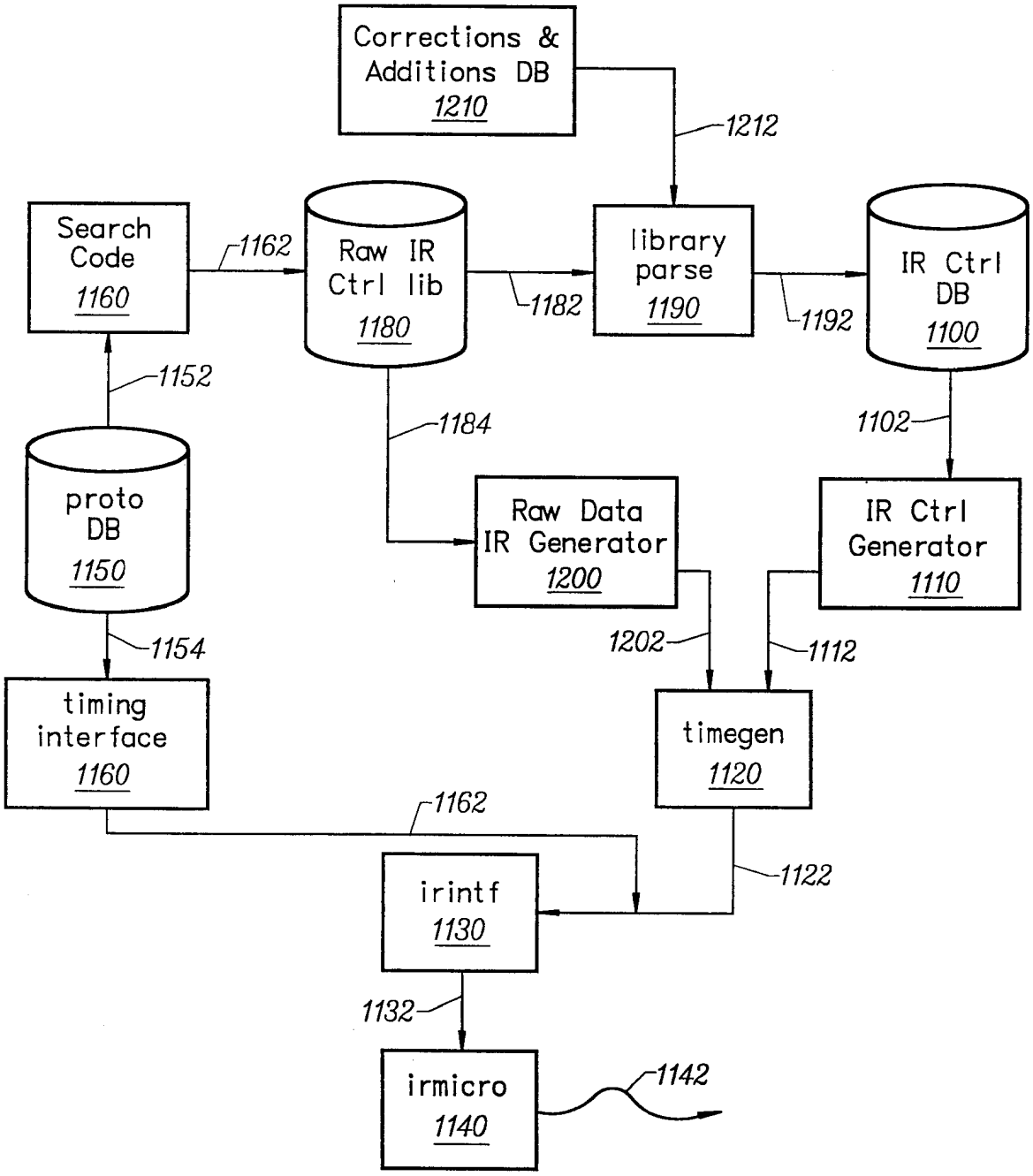
Corrections & Additions DB 1210
1212
Search Code 1160
1162
Raw IR Ctrl lib 1180
1182
library parse 1190
1192
IR Ctrl DB 1100
1152
1184
1102
proto DB 1150
Raw Data IR Generator 1200
IR Ctrl Generator 1110
1154
1202
1112
timing interface 1160
timegen 1120
1162
1122
irintf 1130
1132
irmicro 1140
1142

FIG. 4

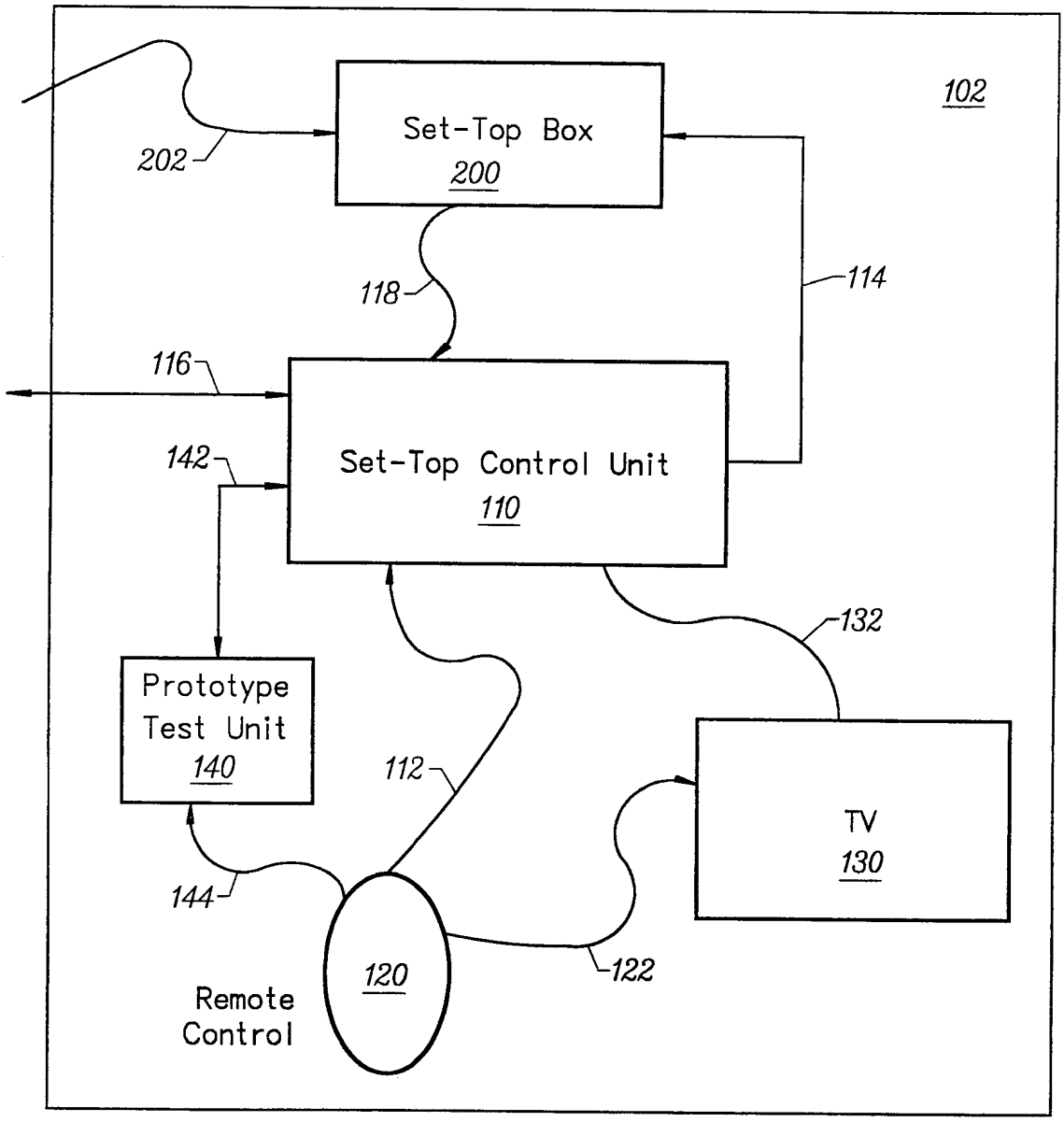
102
Set-Top Box
200
202
118
114
116
Set-Top Control Unit
110
142
132
Prototype
Test Unit
140
112
TV
130
144
120
122
Remote
Control

FIG. 5

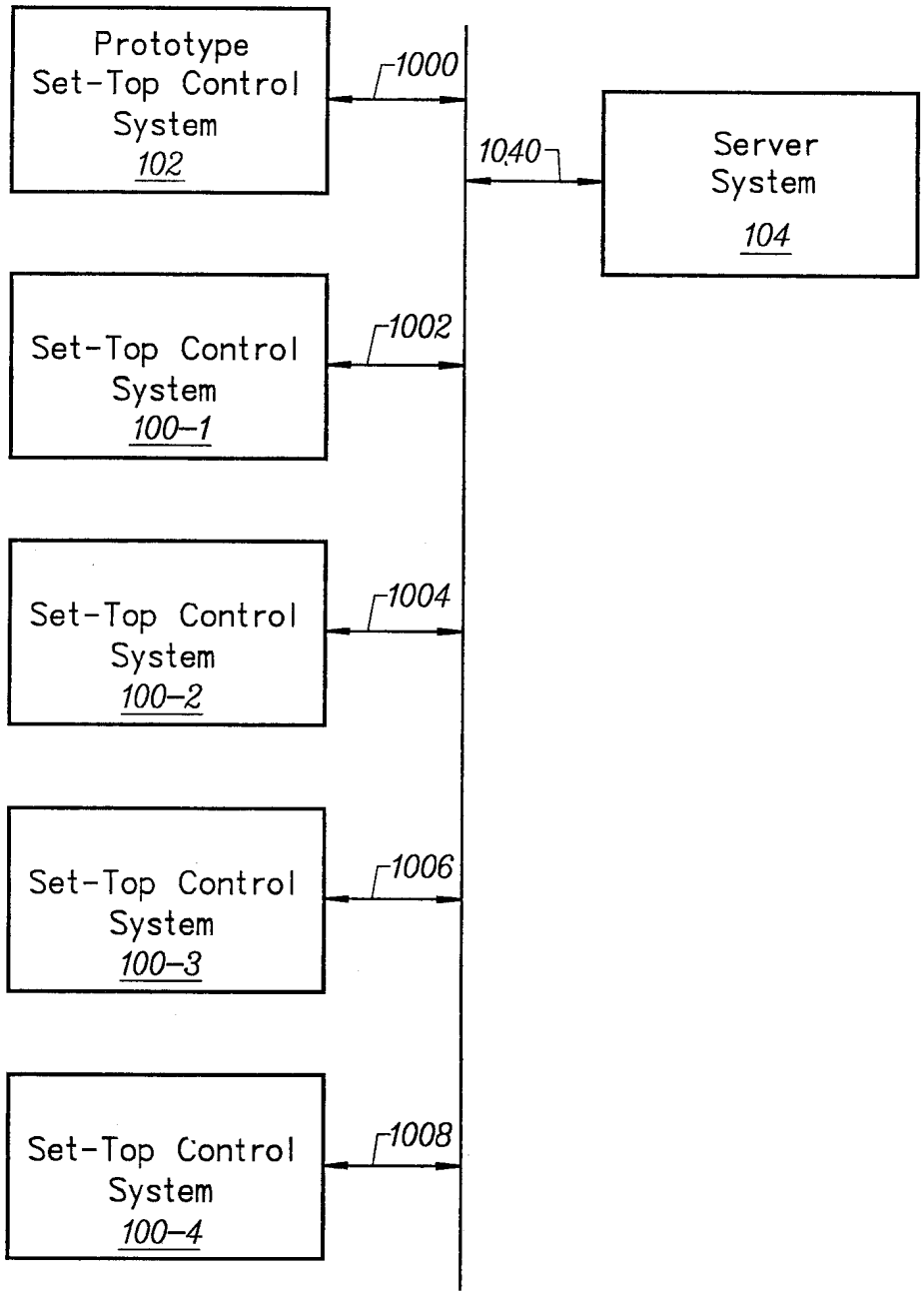
Prototype Set-Top Control System 102
1000
1040
Server System 104
Set-Top Control System 100-1
1002
Set-Top Control System 100-2
1004
Set-Top Control System 100-3
1006
Set-Top Control System 100-4
1008

FIG. 6

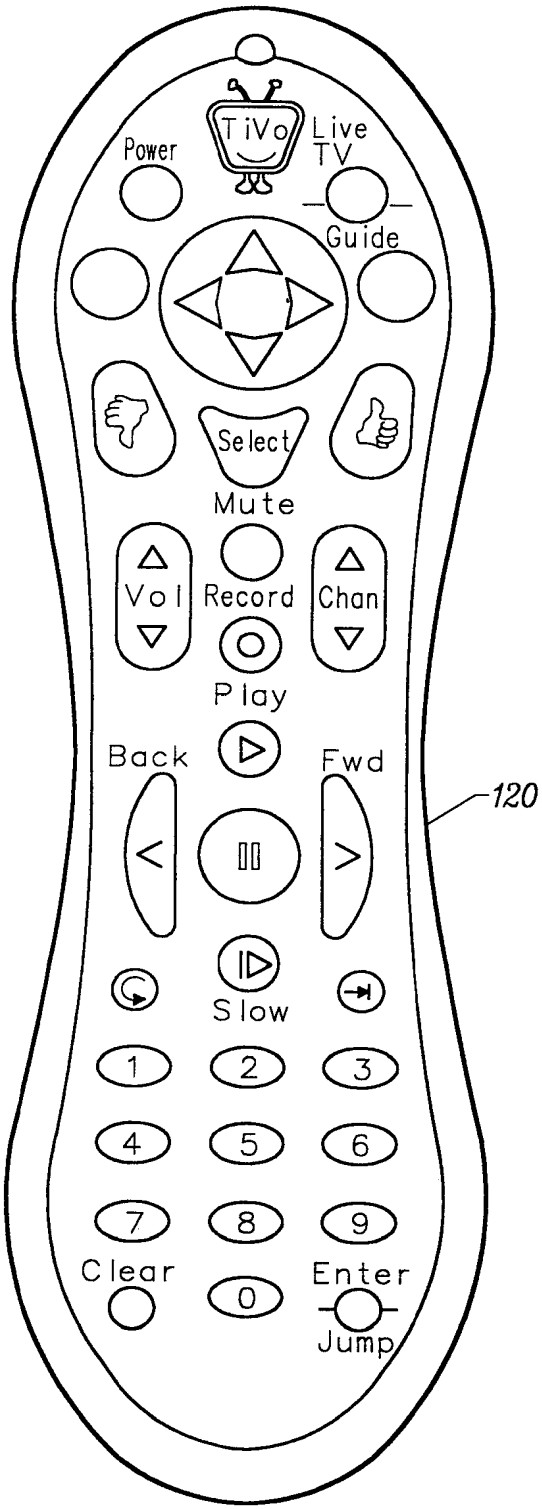
TiVo
Power
Live TV
Guide
Select
Mute
Vol
Record
Chan
Play
Back
Fwd
Slow
1
2
3
4
5
6
7
8
9
Clear
0
Enter
Jump
120

FIG. 7

# INTERNATIONAL SEARCH REPORT

Inter ›nal Application No
PCT/US 00/11495

**A. CLASSIFICATION OF SUBJECT MATTER**
IPC 7 H04N5/445

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
PAJ, WPI Data, EPO-Internal

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category ° | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | WO 98 23088 A (NEXTLEVEL SYSTEMS INC.)<br>28 May 1998 (1998-05-28)<br>the whole document<br>----- | 1-5,20,<br>39 |

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 7 August 2000 | 14/08/2000 |

| Name and mailing address of the ISA | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL – 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,<br>Fax: (+31-70) 340-3016 | Verschelden, J |

1

Form PCT/ISA/210 (second sheet) (July 1992)

# INTERNATIONAL SEARCH REPORT

information on patent family members

Inter nal Application No
PCT/US 00/11495

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| WO 9823088 A | 28-05-1998 | US 6057874 A | 02-05-2000 |
| | | AU 5588098 A | 10-06-1998 |
| | | CN 1238884 A | 15-12-1999 |
| | | EP 0940036 A | 08-09-1999 |